

Nonlinear Parameter-Varying AeroServoElastic Reduced Order Model for Aerostructural Sensing and Control, Phase II

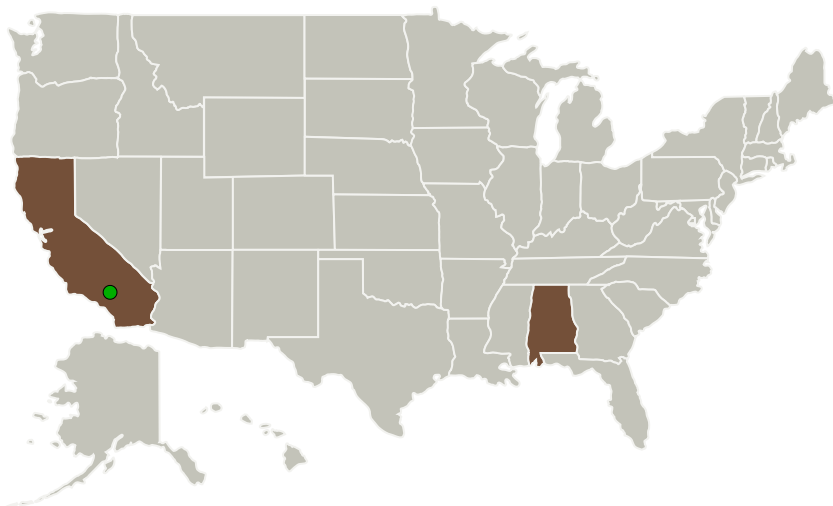
Completed Technology Project (2015 - 2019)



Project Introduction

The overall goal of the project is to develop reliable reduced order modeling technologies to automatically generate parameter-varying (PV), aeroservoelastic (ASE) reduced-order models (ROMs) for aerostructural sensing and control. In Phase 1, both equation-based and data-driven PV ROM technologies were developed and proof-of-principle was successfully demonstrated. A set of carefully selected ROM algorithms and model coupling schemes were developed in an integrated architecture to generate PV ASE ROMs. Critical evidence was established in NASA relevant case studies that ROMs enable unprecedented speedup and accuracy for aircraft ASE analysis. PV ASE ROMs for X-56A MUTT models in the current mission were developed, which demonstrated >10X reduction in the number of states and precise capture of vehicle dynamics at various flight conditions. In Phase 2, software will be expanded and refined for enhanced performance and functionality. ROM algorithms will be optimized in terms of efficiency for MIMO systems, consistent state representation, PV capabilities in a broad flight envelope. PV structural ROM will also be developed to consider changes in modal parameters at various flight conditions. The strategies for integrating ROMs, sensors and actuators with control design for ASE studies will be tailored to meet various needs in NASA. A modular software environment will be developed with facile interfacing to NASA tools for technology insertion and transition. ROM software will be extensively validated and demonstrated for ASE and flight control analysis of the current X-56A MUTT model, its future release, and other relevant aircrafts.

Primary U.S. Work Locations and Key Partners



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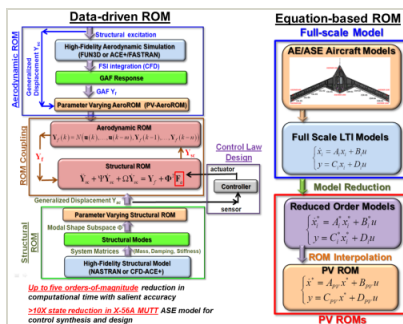


Organizations Performing Work	Role	Type	Location
CFD Research Corporation	Lead Organization	Industry	Huntsville, Alabama
● Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

Primary U.S. Work Locations

Alabama	California
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Images



Briefing Chart

Nonlinear Parameter-Varying AeroServoElastic Reduced Order Model for Aerostructural Sensing and Control Briefing Chart
(<https://techport.nasa.gov/image/133571>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CFD Research Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Yi Wang

Co-Investigator:

Yi Wang

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Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
 - └ TX11.2 Modeling
 - └ TX11.2.4 Science Modeling

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System